

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: April 19, 1946

Released: April 24, 1946

PAN AMERICAN, LATIN AMERICAN DIVISION, TRINIDAD, BRITISH WEST INDIES

JANUARY 8, 1945

The Accident:

Pan American's Flight 161 of its Latin American Division, en route from Miami, Florida, to Leopoldville, Belgian Congo, Africa, crashed during a night landing at Port of Spain, Trinidad, B.W.I. at 2116 EWT^{1/}, January 8, 1945. The accident resulted in fatal injuries to 23 of the 30 occupants, injuries to those surviving, and complete loss of the Martin M-130 flying boat.

Description of the Flight:

Flight 161 departed Miami, Florida, at 0608, January 8, and landed without incident at San Juan Harbor, Puerto Rico, at approximately 1423. After refueling and routine mechanical check, Flight 161 took off from San Juan, at 1605 on a contact flight clearance for Port of Spain, Trinidad, the next scheduled stop. Routine position reports were made at proper intervals and at 1930 the flight received a company message reporting satisfactory contact weather at Port of Spain.

Approaching Trinidad, the plane was being flown from the left Pilot's seat by Captain L. W. Cramer (serving as First Officer of the flight) with Captain C. A. Goyette (in command) in the co-pilot's seat on the right. Approximately 10 miles from the north coast of Trinidad Goyette instructed Cramer to remain in the left seat and to make the approach and landing at Port of Spain.

Crossing the north coast of Trinidad at an altitude of 4,000 feet, a gradual let-down was started. The Port of Spain company station then advised

^{1/} All time referred to herein is Eastern War and based on the 24 hour clock.

Flight 161 that the wind was calm, that lights to mark the landing area on the surface of the water were laid out on a 70° course, that no traffic was in the area, and that it was cleared to contact the company service launch for final landing instructions.

At 2109, Flight 161 was advised, "no traffic, you are number one to land in the Corcorite area." Cramer continued his course over the row of lights and made a turn into the right-hand traffic pattern. Inasmuch as the plane's altitude was too high for the final approach, Goyette advised Cramer that it would be necessary to circle the landing area again. Cramer complied, passed over the landing area a second time and started another 360° turn, this time to the left. Goyette then advised Cramer that, because of adjacent hills, a left-hand pattern was not desirable and Cramer turned into the right-hand pattern. This downwind course was continued for $1\frac{1}{2}$ minutes beyond the No. 1 landing area light. A 180° turn for the final approach placed the plane at approximately 3 miles from the No. 1 light at an altitude of about 1,000 feet.

According to the testimony of Capt. Goyette, a final approach was started with a rate of descent of 600 feet per minute and an airspeed of 105 knots^{2/}. At an altitude of 800 feet the rate of descent was reduced to about 300 feet per minute with the airspeed remaining between 100 and 105 knots. When approximately 700 feet above the surface the left landing light was turned on and the service launch was advised that the flight was on final approach. At an altitude of about 400 feet a light haze was encountered which Captain Goyette stated did not materially affect the visibility. At about 300 feet, the manifold pressure was reduced from 20 to 15 inches in accordance with standard landing procedure. Goyette stated that at this time he noted the position of the aircraft as about $1\frac{1}{2}$ mile from the No. 1 light.

^{2/} 100 knots is approximately 115 miles per hour.

He also stated that at an indicated altitude of 250 feet with airspeed at 100 knots, he called out these readings to Cramer. Soon thereafter, Goyette, whose attention was still focused in the cockpit, heard what he described as a "tearing, shearing" noise, followed by a sudden lurch. As the plane came to an abrupt stop in the water, the hull broke in two at a point about three feet aft of the hull step (about the center of compartment 2) and the rear part of the hull was forced up and forward. Water poured into the cabin and major portion of the flying boat sank immediately. Certain parts of the wreckage remained afloat for a short period while rescue work was conducted by company service launches and Navy rescue and salvage units. The point at which the wreckage sank was $1\frac{1}{4}$ miles short of the No. 1 light which marked the nearest portion of the intended landing area.

Investigation:

During the investigation the surviving three crew members and four passengers described their impressions of the crash. Captain Goyette, seated in the righthand pilot's seat, stated that the "tearing, shearing" noise emanated from a point forward of him, lasted several seconds, and was followed by a "quivering" motion and impact. During this time both Goyette and Cramer were forced forward in their seats. Third Officer S. K. George III, seated and facing aft in compartment 3, said that there was no shock or jar prior to contacting the water, and the sound of contact was deeper than usual and was followed by a violent lurch. He was thrown backwards toward the front of the cabin. Acting Flight Engineer J. W. Morse, seated on the left side of compartment 2 facing forward, had been in the flight compartment prior to the approach and noted that the indications of the 3 airspeed instruments of the pilot, co-pilot and navigator corresponded.

When at an altitude of 40 or 50 feet, Morse noted from his seat in compartment 2 that the left landing light clearly illuminated the surface of the water which was rippled. He further stated that the upper surface of the left sea-wing seemed parallel with the water surface. (This portion of the sea-wing is at a 5-degree up-angle from the keel). Morse's sensation was "momentarily of a normal landing", the plane then lurching violently and stopping abruptly. Passenger C. D. Williams, facing forward in compartment 3, stated that the plane seemed to "settle" just before the crash and that he did not recall any prior shock or noise. Passenger E. A. Prado, facing forward in the lounge, observed that the plane was very low for an appreciable period of time and he noticed several "oscillations" which were followed by the sudden shock of the crash. Passenger A. S. Mackey, also facing forward in compartment 3, recalled nothing prior to finding himself in the water. The fourth surviving passenger was a 7-year old girl.

In analyzing the statements of the survivors, it is apparent that the aircraft's keel first contacted the water at a point well forward, near the bow, while the plane was in a slightly nose-down attitude. Goyette stated that the initial sound of contact emanated forward of the pilot's compartment. Morse's statement suggests a 5-degree nose-down or approach attitude. Considerable sound-absorbing material between the crew and passenger compartments might account for the passengers not having noted the ripping, tearing noise as heard by Goyette and George. Although George was seated in compartment 3 and heard such a noise, this is accounted for by his normal anticipation as an airman in listening for the first sound of surface contact.

Seven lights, marking the landing area, were anchored in a straight line on a bearing of 70 degrees. The distance from No. 1, on the approach

end, to No. 2 was 1500 feet. Others up to No. 6 were 750 feet apart. No. 7 was 3,000 feet beyond No. 6 and marked the extreme limits of the available landing area totaling 7500 feet in length. These lights were of a fluorescent type and are considered to be highly satisfactory for night landings during normal weather conditions. No weather handicaps prevailed during the approach or landing. Visibility was unlimited.

Witnesses to the approach who were on the company service launches saw a single landing light approach with uniform and even descent until it appeared to be at water level when it suddenly went out. Company procedure provides that when the second landing light is turned on during the approach it constitutes a signal for the firing of a flare from the company launch as an aid to the pilot in gauging accurately his height above the water. In this instance, the pilot did not turn on the second landing light during his approach.

Examination of the wreckage revealed no indication of malfunctioning of any part of the airplane prior to its impact with the water. Both wings were broken off; the left wing and left sea-wing received more damage than those on the right. The hull was broken in two at the center of No. 2 compartment, approximately 3 feet aft of the hull step. The forward portion of the hull was badly damaged, the rear portion was buckled and forced in an upward direction, and the extreme rear section of the hull received little damage. Approximately 400 square feet of the hull bottom was not recovered. This section of the bottom covered an area from a point a few feet aft of the bow to the region of the step, the hull skin having failed predominantly in an outward direction.

The left altimeter setting was found to be very close to the then existing station pressure of 1014.6 millibars. The right altimeter, from which Captain Goyette called off the altitude of 250 feet, was found set at

1014.2 millibars, a discrepancy between the two altimeters amounting to only 11 feet in altitude. The Kollsman repeating compasses on the instrument panel were found set at 77° magnetic, or 70° true, the bearing of the line of lights at the landing area.

The aircraft was equipped with an NACA V-G recorder, the purpose of which is to record vertical acceleration in relation to speed. This recorder was recovered from the wreckage and a detailed discussion of the results obtained from a study of the recording is included herewith as Appendix I. In brief, the V-G record, as well as the condition of the bottom of the hull as described above, indicated that: (1) the aircraft contacted the surface of the water at a higher than normal landing speed, and (2) the impact occurred while the aircraft was in a nose-down attitude.

During the salvage operations there were found in various places small particles of wood, oakum, and paint chips. Inasmuch as the presence of this material within the wreckage suggested a possibility of collision with some wooden vessel or object, specimens were referred to the Federal Bureau of Investigation, together with samples of wood and paint from the U. S. Navy salvage boats and from the piling and pier at the docksite where the wreckage was finally placed. Examination by that agency revealed that these various articles corresponded to the materials of the salvage boats or the docksite, thus eliminating the probability of the plane's having collided with any such object prior to impact with the water. Examination of the wreckage revealed no evidence of collision with any object either in the air or on the surface of the water.

Captain Goyette was an experienced pilot with an accumulated total of about 7040 flying hours. He had served nine years with Pan American and at the time of the accident was rated by the company as Master Pilot. Although

Goyette had flown Martin M-130 aircraft a total of approximately 1560 hours, he had never made a night landing in that type of aircraft at Port of Spain. Moreover, for at least two years and two months prior to the accident, Goyette had acted in the capacity of assistant chief pilot in charge of personnel, and although his duties included that of check pilot he was not a regular pilot on scheduled trips between Miami and Port of Spain at the time. However, Captain Goyette had made the proving run over this route three months prior to the accident to the satisfaction of a CAA Air Carrier Inspector and had since that time completed two additional flights. His wide experience in flying boat operation in addition to his familiarity over the route leaves no doubt that Goyette was qualified to serve as captain of this flight.

Captain Cramer's flying experience totaled approximately 7034 hours of which about 882 hours were flown in Sikorsky S-42 four-engine seaplanes. His employment with Pan American dated from April 1, 1942, and he had served as co-pilot and then as captain in the company's Eastern Division. The subject trip was the first flight made by Cramer over this route. Cramer had been checked out by the company in the Martin M-130 type aircraft three days before the departure of Flight 161, and this flying time, with the addition of his time for a portion of the flight from Miami to Port of Spain, constituted his total flying experience in an M-130. The company check flights in the M-130 included night landings but without cargo or passengers. Cramer's pilot certificate required him to wear corrective lenses when piloting, but he was not wearing glasses at the time of the accident.

Discussion:

Statements of the surviving occupants of the aircraft, examination of the damaged hull, and the record inscribed by the NACA V-G recorder leave little doubt that the Martin M-130 first contacted the water at more than normal landing speed and in an excessively nose-low attitude. Forces created by the

speed of the aircraft in the nose-down attitude on its contact with the water caused failure of the hull bottom and its structure, resulting in rapid submersion.

Landing of the aircraft on the surface of the water in the attitude indicated, and under the then existing conditions of water surface and weather, was undoubtedly due to the pilot's having misjudged his true altitude above the surface prior to contact with the water and his failure to correct the attitude for a normal landing at the proper moment.

It is difficult to judge altitude precisely above the surface of very smooth, glassy water. There is a possibility that patches of glassy water existed at the time of the accident inasmuch as light winds prevailed and the landing area was on the lee side of hilly terrain, a condition conducive to smooth water. However, one occupant of the aircraft noted just prior to the landing that the surface was rippled. With the assistance of some rippled water and the row of lights marking the landing area, it should not have been difficult for pilots seasoned in seaplane operations, as were both Goyette and Cramer, to have effected a normal and smooth landing.

In view of the fact that the rate of descent and airspeed of the aircraft during approach were not unusual and inasmuch as the accident occurred $1\frac{1}{4}$ miles short of the first light, it is apparent that the approach was begun at too great a distance from the landing area. Approach from an altitude of 1,000 feet but at an excessive distance from the landing area would reduce the angle from which the row of lights was viewed by the pilots. The practice of spacing such landing area lights as hereinbefore described is to assist the pilot in gauging more accurately his altitude above the surface and distance from the intended point of landing. Reduction of the angle of view of these lights would tend to merge the individual lights into one elongated light, rendering the pilot's judgment of distance more difficult. When presumably at an altitude of 300 feet, Goyette misjudged the aircraft's position as $1\frac{1}{2}$ mile from

No. 1 light.

Statements from the company doctor indicated that Cramer's visual defect was of a mild nature and that under the conditions that then existed he should have been able to see the entire landing path without difficulty. CAA medical examiners found the above statements to be consistent with the medical reports concerning Cramer contained within CAA records for the preceding five years. However, in view of the fact that his vision without glasses was inferior to that normally required of an airline transport pilot, his failure to wear glasses cannot be dismissed entirely and may have contributed to his error in judgment of correct altitude just prior to impact.

Knowledge of Cramer's considerable previous experience with four-engine flying boats would have justified Captain Goyette in assuming that Cramer was capable of negotiating the landing safely; and, therefore, Captain Goyette is not subject to criticism for directing First Officer Cramer to execute the approach and landing. However, since Cramer's total experience in the Martin M-130 type included less than a two-hour company check-out at Miami and a portion of the flight time to Port of Spain, Captain Goyette should have been particularly alert to his responsibility that the aircraft be landed safely. Proper exercise of this responsibility required a greater attention to the attitude of the aircraft and its relation to the water than to any particular instrument indications. The statement made by Captain Goyette that his attention "was still in the cockpit" during the final stages of the landing indicates his preoccupation with the instruments and his failure at the crucial moment adequately to monitor his copilot's approach to a safe landing.

Findings:

Upon the basis of all available evidence, the Board finds that:

1. The carrier, aircraft and pilots were properly certificated.
2. Captain Cramer, having very limited flight time in the aircraft, was at the controls with Captain Goyette acting in a supervisory capacity.
3. Conditions of weather and water surface within the vicinity of Port of Spain were satisfactory for a safe approach and landing.
4. The plane first contacted the water at more than normal landing speed and in a nose-low attitude.
5. The crash occurred at a point $1\frac{1}{4}$ miles short of the intended landing area.
6. Forces created by the speed of the plane on its contact with the water in the excessive nose-down attitude caused failure of the hull bottom and its structure, resulting in rapid submersion of the aircraft.
7. Landing of the aircraft in the attitude indicated, under the then existing conditions of water surface and weather, was due to Cramer's having misjudged his true altitude and his failure to correct his attitude for a normal landing.
8. At the time of the accident Captain Cramer was not wearing glasses as required by his pilot certificate.
9. Captain Goyette, in command of the aircraft and with full knowledge of Cramer's limited experience in the Martin M-130, failed to exercise sufficient supervision of the landing.

Probable Cause:

On the basis of the above findings, the Board determines that the probable cause of this accident was (1) First Officer Cramer's failure to realize his proximity to the water and to correct his attitude for a normal landing and, (2) the lack of adequate supervision by the Captain during the landing.

resulting in the inadvertent flight into the water in excess of normal landing speed and in a nose-down attitude.

BY THE CIVIL AERONAUTICS BOARD:

/s/ L. WELCH POGUE

/s/ OSWALD RYAN

/s/ HARLEE BRANCH

/s/ JOSH LEE

/s/ CLARENCE M. YOUNG

SUPPLEMENTAL DATA

Investigation and Hearing

The Atlanta Office of the Civil Aeronautics Board received notification at 2320 on January 8, 1945, and the Board initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the amended Civil Aeronautics Act of 1938. The Senior Air Safety Investigator in charge of the Atlanta Office proceeded to Port of Spain, arriving there about 2045 on January 10, and started the investigation. Other members of the Board's Safety Bureau staff arrived shortly thereafter.

In connection with the investigation the Board ordered a Public Hearing in which the Chief of the Investigation Section served as Presiding Officer with others of the Board's Safety Bureau staff participating. The hearing was held at Miami, Florida, on January 29, 30 and 31, 1945.

Air Carrier

Pan American Airways, a New York Corporation with headquarters in New York and its Latin American Division offices in Miami, was operating at the time of the accident as an air carrier under a currently effective certificate of public convenience and necessity and an air carrier operating certificate. These certificates authorized it to transport persons, property and mail between various points, including Miami, Florida; San Juan, Puerto Rico; and Port of Spain, Trinidad, B.W.I.

Aircraft

Aircraft NC 14716, a Martin M-130, was purchased new by Pan American in October, 1935. The aircraft was transferred to the United States Navy during the early part of the war and Pan American reacquired it on October 13, 1943. It was powered by four Pratt and Whitney S2A5G engines and was equipped with Hamilton Standard constant speed propellers.

At the time of the accident, the aircraft had been flown a total of 20,545 hours. The airplane and its equipment had been given a preflight inspection immediately prior to departure from Miami. It was loaded with its center of gravity at 33.4% of the mean aerodynamic chord which was within the acceptable limits. The total weight upon take-off from San Juan was 21,198 kgs. (46,720 lbs.), which was within approved limits.

The airplane was properly certificated and in an airworthy condition when it was dispatched from Miami, Florida, on January 8, 1945.

Flight Personnel

The pilots on duty at the time of the accident were Captain Cyril Adrian Goyette, age 35, of Coral Gables, Florida, and First Officer Leonard Wright Cramer, age 38, of Miami, Florida. First Officer Cramer, who was at the controls at the time of the landing, did not survive the accident.

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APPENDIX I

V-G RECORDER

The V-G recorder was recovered and after a cursory inspection of the recording glass the complete instrument was shipped to the National Advisory Committee for Aeronautics for study and interpretation.

Although it had been subjected to the action of salt water for a period of about 24 hours immediately after the crash, relatively little of the smoked surface had been washed off the recording glass. Special tests conducted by the NACA revealed that newly applied smoked surface is immediately washed away simply by immersion in water. However, the effect of immersion is appreciably reduced if the smoked surface is old. This recording glass had been smoked prior to December 5, 1944, and therefore the smoked surface was apparently old enough to resist, to a great extent, the action of salt water. Thus it was possible to obtain from the record some significant information.

On the record were three areas of high "G's"; a negative area in a velocity range within and up to about 130 m.p.h., a positive area in the range of 100 to 170 m.p.h., and another negative area above 170 m.p.h. Except for a portion of the last mentioned the high "G" scratches in all three areas are typical of marks made by a recorder during a crash. Such marks are usually in the form of irregular scribbling, with the stylus skipping while the various loops are being formed. Furthermore, the high speed negative area and the positive area appear to be interrelated inasmuch as the two loops have the same slope and match each other; also the maximum absolute "G" values are about the same; i.e., 4G.

Greatest significance was attached to a loop within the high speed negative area. This loop intersected the $\pm 1G$ line at approximately 170 and 200 m.p.h., and the net acceleration at the crest was noted as $-3G$. That this loop was not a part of the irregular "crash" scratches within the same area is evident by the following characteristics. First, the loop has a smooth and regular appearance devoid of stylus skip or chatter. Secondly, the higher speed segment of the loop is not in line with, but somewhat separated from, the irregular scribbles previously noted. This regular loop evidently was caused prior to the breaking up of the airplane. The characteristics of the loop, as expressed by its slope and the negative "G" value, are not consistent with the supposition that the loop had occurred in free flight. Therefore, the only remaining possibility is that the loop was the result of the airplane's contact with water.

In order to reconcile the latter supposition with the negative acceleration present and with the relatively high velocity registered, the NACA conducted a series of hydrodynamic tests. These tests were run at Langley

Field in the impact basin and employed a hull model with bottom lines comparable to those on the M-130. The results indicate that when the hull strikes the water under certain conditions, its bottom is subjected not only to local negative pressures (suction) but also to a net negative acceleration. The conditions during which this occurred were found to be a -3° trim of the hull keel, a relatively high speed, and a flight path angle slightly less than zero. This seems to correspond to an airplane in a shallow descent with nose down and at a high speed, probably with some power being applied. The tests further revealed that under the above conditions extremely high drag deceleration is developed. Although the V-G recorder is not designed to register directly the acceleration (or deceleration) in the drag direction, nevertheless the presence of decelerating forces acting in the drag direction is apt to affect the recorded velocity values. With the instrument orientated as it was on the subject aircraft (velocity axis in the fore direction) the inertia of the stylus in the presence of a drag deceleration will result in higher than actual speeds being recorded.

Due to the complex nature of the problem and with the testing facilities available at the time, it was not possible to conduct tests which would give accurate quantitative results. However, the qualitative results were such as to be consistent with the negative acceleration within the high velocity range indicated on the V-G record. The speeds registered (170-200 m.p.h.) appear to be extremely high, and are not easily reconciled with known facts surrounding this accident. A study of both the airspeed indicating system and the system supplying the V-G recorder offers no explanation as to why the latter registered a speed greatly exceeding that which Captain Goyette last noted on the airspeed indicator. There was no evidence found that water had accumulated in any portion of the two systems, nor that these systems were otherwise not operating within reasonable accuracy. Consequently, it is not possible to establish, even approximately, the speed with which the aircraft hit the water, except to state that it was probably higher than would be expected during a normal landing.

It was therefore concluded by NACA that the regular negative loop within the speed range of the V-G record was caused most probably by the impact of the aircraft with water at a relatively high speed. The resultant negative value of acceleration seems in line (at least insofar as direction is concerned) with the results of the hydrodynamic tests. The high values of impact speed (170-200 m.p.h.) are not readily explainable and should be tempered in view of other known facts. Further it appears that the impact took place while the aircraft was descending at a very shallow flight path angle with the nose slightly depressed from the normal horizontal trim attitude.